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Published in:

ISSM 2011 - microbial life below our feet

Publication date:

2011

Document Version

Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Levi, S., Bjerg, P. L., & Albrechtsen, H-J. (2011). Effects of biodegradation of mecoprop, dichlorprop and bentazone by changing the redox conditions from anaerobic to aerobic in sandy aquifer. In *ISSM 2011 - microbial life below our feet: Final Programme and Abstracts* ISSM. <http://www.issm2011.com/>

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Effects of biodegradation of mecoprop, dichlorprop and bentazone by changing the redox conditions from anaerobic to aerobic in sandy aquifer

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Pesticides and metabolites are detected in an increasing number of aquifers resulting in closure of many drinking water wells. The natural redox conditions of aquifers are considered to be one of the important factors governing the pesticides degradation in groundwater. Water abstraction strategy in combination with geological variations may affect microbial degradation processes by mixing in even low oxygen concentrations and create steep gradients and drastic redox zones in aquifers. The aim of the current study was to investigate the stimulation of pesticides biodegradation by adding oxygen concentration range 0.0-11mg/L. We have studied effects of oxygen addition to anaerobic sediment on biodegradation of 1 µg/L mecoprop, dichlorprop and bentazone by microcosm experiments in 48 incubations for 130 days. A significant increase of mecoprop degradation was obtained (18-20%) at high oxygen concentrations of 9-11mg/L where 8.5% of mineralized at 2mg/L. Dichlorprop was mineralized to some extent (4-5%) at 9-11mg/L oxygen concentration. 10-15% of bentazone degradation was observed at high oxygen concentrations (8-11mg/L) and 3-5% mineralized at relatively low concentrations (0.5-2mg/L). To our knowledge, this is the first observation of bentazone degradation with aquifer. Optimization of redox conditions from anaerobic to aerobic by adding oxygen stimulated the biodegradation of three pesticides.